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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/582,330	06/09/2006	Hitoshi Sumiya	070456-0115	4934

20277 7590 06/15/2011

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EXAMINER	
DAVIS, SHENG HAN	

ART UNIT	PAPER NUMBER
1732	

NOTIFICATION DATE	DELIVERY MODE
06/15/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/582,330	Applicant(s) SUMIYA, HITOSHI	
	Examiner SHENG H. DAVIS	Art Unit 1732	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 12-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 12-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's arguments filed March 21, 2011have been fully considered but they are not persuasive.

First, Applicant contends that although Meng teaches how much boron is used in the source material, it does not necessarily teach now much is in the final product. However, it is expected that when using an amount of starting material that, without otherwise converting or removing the compound, the same amount should be present in the final product. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that if .1 to .5% of boron is used (corresponding to 1,000 to 5,000 ppms) that the same amount would incorporate into the diamond. This amount overlaps the claimed range.

As to the solid solution feature, since the claim is a product by process type, it does not require the same process steps as those stated. In fact, Applicants disclosure indicate that the same product can be made by either a boron solid solution or use of boron in other forms, such as a boron-containing carbon material (PG Pub, para. 0012).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

> invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

    1. Determining the scope and contents of the prior art.
    2. Ascertaining the differences between the prior art and the claims at issue.
    3. Resolving the level of ordinary skill in the pertinent art.
    4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 12, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sung (2005/0019114) and further in view of Meng (2003/0039603).

As to Claims 1 and 12, Sung teaches a process for making nanodiamonds using an HPHT process (para. 0033). The diamond particles are nanosized (para. 0006) and can average between 1nm to 500micrometers (para. 0034). The diamond can be doped by boron (para. 0024). The diamond starting material can be graphite (para. 0025, 0028) and the diamond is self sintering, which Sung defines as: "self-sintered"

refers to particles which sinter together without the use of a secondary material. Thus, for example, nanodiamond particles can sinter together to form a substantially continuous network of diamond *without the use of typical infiltrants or sintering aids*. Further, self-sintering indicates that the nanodiamond particles are sintered without an additional carbon source, such as fullerenes, graphite, or the like (para. 0028).

As to the use of boron in solid solution, since this is a product by process claim, the patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.

Although Sung teaches these features, it is not clear that the boron atom is included in the lattice sites of the diamond particle or that between 100-1,000ppms or 1,000-100,000 boron is included in the lattice site of the diamond.

Meng teaches a method for synthesizing boron doped diamond for improving the oxidation resistance of said diamond crystals includes forming a fully dense core (mixture) of graphite with a source of boron (abstract). This mixture is subjected to diamond-formed high pressure/high temperature (HP/HT) conditions for a time adequate for forming diamond. The thus-formed diamond product is recovered to contain boron substituted into the diamond structure (abstract). The fully dense core is substantially devoid of nitrogen (N) content, which mostly comes from air (abstract). Thus, the fully dense core is substantially devoid of air. The preferred source of B is

amorphous B; although other sources of B can be used to form the boron-doped, blue diamond of the present invention (abstract).

Meng describes this method for producing boron doped diamond that includes forming a fully dense core (mixture) of graphite, an optional diamond seed crystals, and a source of boron (para. 0009). The thus-formed diamond product is recovered to contain boron substituted into the diamond structure. The preferred source of 13 is amorphous B; although other sources of B can be used to form the boron-doped, blue diamond of the present invention (para. 0009).

The boron itself is substituted into the diamond structure (para. 0009 and 0014). *The amount of boron used can be between 0.1 to .5 wt %* (para. 0016).

It would have been obvious to one of ordinary skill in the art at the time of the invention that applying the same type of high temperature, high pressure process to a diamond polycrystalline nanoparticle with boron would result boron being deposited within the lattice of the diamond particle, as taught by Meng, in the process of Sung because the HPHT process is known to cause boron atoms to deposit inside the diamond lattice.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use between 0.1-0.5 wt%, which corresponds to 1,000 ppm to 5,000, of boron in the formation of boron doped diamond, as taught by Meng, in the process of Sung because it is known to use this amount of boron to produce the desired result, and would obviously result in boron included in the diamond within the claimed ranges of 100-1000 ppm and 1000-100,000 ppm.

Furthermore, it would be obvious to one of ordinary skill in the art at the time of the invention that the amount of dopant used constitutes optimization of a known process, which could have been determined through routine experimentation, and is held to be obvious by *In re Boesch,* 205 USPQ 215.

Claims 2, 3, 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sung and Meng as applied to claim 1 above, and further in view of Swain.

As to Claims 2, 3 and 13, Sung and Meng teach a process for making boron doped diamond particles using a HPHT process without the use of sintering aides, but they do not teach the specific resistance of the diamond.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). The diamond particles are disclosed to be between 10-16nm in size (para. 43) or 20nm (para. 0031) and the boron concentration is between 1 to 20ppm (para. 0034 and 0071). The elemental boron is in the crystal as a dopant (para. 0011, 0012). This boron is incorporated within the lattice of diamond lattice (para. 0071). The diamond nanocrystals are highly conductive (para. 0031(i)). Swain teaches an electrical resistance of 0.2 ohm cm (para. 0031). This is less than 10 ohm cm.

It would have been obvious to one of ordinary skill in the art at the time of the invention that the conductivity of the boron doped diamond could be less than 10ohm cm, as taught by Swain, in the same boron doped diamond nanoparticle described by Sung and Meng because diamond particles with this type of modification are known to have a high conductivity and a low resistance.

As to Claim 14, Sung teaches that the average particle diamoneter can be from 2nm to 30nm (para. 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention that the maximum particle diameter can be lower than 1,000nm.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sung and Meng or Sung and Meng in view of Swain as applied to Claims 1 or 2, respectively, and further in view of Akaishi (WO2004/046062). Please see the corresponding US version (2006/0115408).

Meng, Sung and Swain teaches a method of making diamond particles using carbon and boron doping using high temperature and high pressure conditions but neither of them teach a specific pressure of 80-110 GPa.

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the superhard diamond with a hardness of over 80 and 110 GPa, as taught by Akaishi, for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure, in the invention described by Meng and Swain.

Claims 15, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sung and Meng or Sung and Meng in view of Swain as applied to claims 12 and 13 above, respectively, and further in view of Akaishi (WO2004/046062). Please see the corresponding US version (2006/0115408).

Meng, Sung and Swain teaches a method of making diamond particles using carbon and boron doping using high temperature and high pressure conditions but neither of them teach that the polycrystalline body has a hardness of at least 80GPa or 110Gpa.

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the superhard diamond with a hardness of over 80 and 110 GPa, as taught by Akaishi, for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure in the invention described by Sung, Meng and Swain.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHENG H. DAVIS whose telephone number is

(571)270-5823. The examiner can normally be reached on Monday-Friday, 9:30-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SHENG H DAVIS/
Examiner, Art Unit 1732

June 3, 2011

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1732